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DRAWINGS ATTACHED

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(54) APPARATUS FOR SHEARING METAL SECTIONS

(71) We, SCHLOEMANN AKTIENGESELLSCHAFT, a German Company, of Steinstrasse 13, 4 Düsseldorf 1, Germany, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The invention relates to apparatus for shearing metal sections, wherein a cold shear has two blade members of special shape. The invention is particularly applicable to the shearing of channel sections, I-shaped beams and T-shaped beams.

When sections are cut using cooling bed shears, the cuts are not clean since in places the stock must be cut while positioned edgewise, i.e. a limb of the section extends in the direction in which the blades of the shear move. As viewed from the side, the cuts are in the shape of a flash of lightning, i.e. jagged such that the splits extending from the cut made by the upper or lower blades are shifted relative to each other and do not meet. Forced ruptures are produced transversely to the desired shearing surface.

It is not practicable to increase the distance between the blades in a direction perpendicular to the direction of cutting since then the sections would not be cut through in the vicinity of portions of the section which extend largely perpendicular to the direction of cutting. Ideally, a section is sheared perpendicular to its length so as to provide a clean, smooth planar end surface. When positioned in a shear, a section has a plane of shearing in which the section will be sheared if the shears operate in an ideal way. In the present specification the term "plane of shearing" is used even when non-ideal shear conditions occur and a non-planar line of shearing occurs.

According to the present invention there is provided apparatus for shearing metal sections of non-uniform dimensions in the shearing direction, comprising two blade members arranged to be on opposite sides of the sections, each blade member having a cutting edge arranged to engage a surface of the section, each cutting edge having a profile substantially corresponding to the profile of the surface which it is to engage, the blade members being relatively movable towards one another in a shearing direction and being able to be positioned on opposite sides of the plane in which the section is to be sheared, and at least one of the blade members having its cutting edge and a blade face facing the plane of shearing such that where the profile corresponds to a portion of the section having a greater dimension in the shearing direction than an adjacent portion of the section, the corresponding portions as hereinafter defined of the cutting edge and of said blade face, respectively, are arranged to be a greater distance from the plane of shearing than the corresponding adjacent portions as hereinafter defined of the cutting edge and said blade face.

By "corresponding portion" of the cutting edge or the blade face, we mean the portion which will engage and shear that portion of the section having a greater dimension in the shearing direction, and "corresponding adjacent portion" means the portion which will engage and shear the said "adjacent portion of the section", which will have a lesser dimension in the shearing direction.

The invention can provide a smooth parting cut through channels or U-shaped beams, universal or I-shaped beams and T-shaped beams, which do not require subsequent machining to provide a clean end; furthermore, the invention can provide a shear having all the requirements of cutting tools.

By increasing the distance between the blades (in a direction perpendicular to the direction of cutting or shearing) adjacent the portions of the section which have a dimension in the direction of shearing greater than an adjacent portion, e.g. vertical flanges extending from a horizontal main portion of a section, it is possible to obtain straight splits through the section. It is also possible to ensure a smooth cut.

In an embodiment of the shear apparatus

[1

according to the invention, the said corresponding portion of the cutting edge and of the blade face may be formed by providing a recess, in the blade face, extending in the shearing direction.

In addition, or as an alternative, the said blade face of said at least one blade member may be arranged to be inclined at an angle of up to 10° from the shearing plane such that any portion of the cutting edge further from the other blade member than any other portion is at a greater distance than that other portion from the plane of shearing.

Preferably the inclination is within the range of 1 to 10°.

The inclination can be provided by grinding said blade face or alternatively by mounting the blade member at an angle.

In embodiments of the apparatus according to the invention, the distance between the blade members can be provided by a recess or inclination in either or both of the upper and lower blade members.

The invention will be further described, by way of example, with reference to the accompanying drawings, of which:—

Figure 1 shows in front view blade members for cutting T-shaped sections, the blade members having groove-shaped recesses;

Figure 2 is a plan view of the arrangement of Figure 1;

Figure 3 shows in front view blade members for cutting I-shaped sections, the blade members having groove-shaped recesses;

Figure 4 is a plan view of the arrangement of Figure 3;

Figure 3a shows in front view blade members cutting channel sections, the blade members having groove-shaped recesses;

Figure 4a is a plan view of the arrangement shown in Figure 3a;

Figure 5 shows in front view blade members for cutting channel sections, one of the blade members having an inclined face facing the shearing plane;

Figure 6 is a side view of the arrangement of Figure 5;

Figure 7 shows in front view blade members for cutting T-shaped sections, one of the blade members having an inclined face facing the shearing plane;

Figure 8 is a side view of the arrangement of Figure 7;

Figure 9 is a front view of blade members for cutting a universal beam, both the blade members having an inclined face facing the shearing plane;

Figure 10 is a side view of the arrangement of Figure 9; and

Figures 11, 12 and 13 are side views of blade members in a further embodiment of the invention wherein one or both of the blade members is/are bodily inclined for cutting T-shaped sections, channel sections and I-shaped sections respectively.

As shown in Figures 1 and 2, T-shaped sections are usually cut with the stem of the T pointing upwards; a lower blade 1 has recesses 1a along its upper surface in each of which the flange or base of one inverted T-section is inserted, while an upper blade 2 has recesses 2a in which the stems of the T-sections P1 are inserted. In addition, the upper blade 2 has vertically extending, groove-shaped recesses 2b along its faces extending from its cutting edge, the recesses 2b acting to increase the distance *Sp* between the blades in the region corresponding to the stem of the T-section P1.

This can result in an improved cutting performance of the upper blade 2 when the stem of the section P1 is cut through and causes the two ends which have been separated from one another to be torn apart, so that clean, angled cuts can result instead of the lightning-shaped jagged cuts achieved hitherto. The invention is based on the fact that the small distances *Sp* required between blades in cutting sections is only needed in order to ensure that stems or flanges which extend horizontally are cut through cleanly and are not crushed. However, since the vertical thickness of sections requires a certain distance between the blades if it is to break cleanly, an allowance is made for this by the widening of the gap *Sp* between the blades at these points.

As shown in Figures 3 and 4, the universal or I-shaped sections P2 are sheared while lying with the webs horizontal; a lower blade 5 and an upper blade 6 are provided with recesses 5a and 6a in which the flanges of the sections P2 are inserted. The webs of the sections P2 lie in recesses 5c and 6c in the lower blade 5 and upper blade 6 respectively. In order to widen the gap *Sp* between the blades at the points corresponding to the flanges of the sections P2, which are to be cut through vertically, the lower blade 5 and upper blade 6 are provided with groove-shaped recesses 5b and 6b.

As shown in Figures 3a and 4a, channel sections P3 are usually cut with the webs positioned uppermost. An upper blade is shown at 8 and a lower blade 7. The upper blade 8 has groove-shaped recesses 8a to accommodate the web of the section P3 while the lower blade 7 has recesses *Fa* for the flanges of the section P3 and groove-shaped recesses 7b which increase the distance *Sp* between the blades.

Figures 5 to 13 show embodiments of the invention, in which the distance between the blades at points corresponding to increased height of portions of the sections is provided by grinding the blades at an angle, or positioning one or both blades at an angle.

In Figures 5 and 6, 10 is an upper blade and 11 a lower blade which are used to cut through channel sections PIII. The lower blade 11 is ground, at least adjacent to the

flanges of the section P III and adjacent the web on the blade face facing the shearing plane, at an angle $\alpha=1°$ to $10°$ so that where the cutting edge of the blade is profiled to correspond to vertically extending flanges of the section, due to the inclination of the blade face the gap *Sp* between the blades is increased then. As Figure 6 shows, the lower blade 11 is in fact ground uniformly, at the angle α.

Figures 7 and 8 show an upper blade at 12 and a lower blade at 13, used for cutting T-sections P1. The upper blade 12 is here ground at an angle $\alpha=1$ to $10°$ at the face facing the shearing plane in a manner similar to that shown in Figures 5 and 6.

In Figures 9 and 10, 14 is an upper blade and 15 a lower blade used for cutting universal beams PII. The upper blade 14 and the lower blade 15 are here both ground at an angle $\alpha=1$ to $10°$ at the face facing the shearing plane in a manner similar to that shown in Figures 5 and 6.

Figures 11 to 13 show an embodiment of the invention in which the inclination is provided in a different manner. Here instead of the blades being ground at an angle of $\alpha=1$ to $10°$, the blades are inclined at an angle of $\alpha=1$ to $10°$, so that again the gap *Sp* between the blades is widened at the regions of the portions of the blades corresponding to vertically extending flanges of the beams. The cutting edges of the blades must extend in a horizontal plane in order to avoid the material being crushed. The blade arrangement shown in Figure 11 is particularly suitable for T-sections, that in Figure 12 for channel sections and that in Figure 13 for universal sections.

WHAT WE CLAIM IS:—

1. Apparatus for shearing metal sections of non-uniform dimensions in the shearing direction, comprising two blade members arranged to be on opposite sides of the section, each blade member having a cutting edge arranged to engage a surface of the section, each cutting edge having a profile substantially corresponding to the profile of the surface which it is to engage, the blade members being relatively movable towards one another in a shearing direction and being able to be positioned on opposite sides of the plane in which the section is to be sheared, and at least one of the blade members having its cutting edge and a blade face facing the plane of shearing such that where the profile corresponds to a portion of the section having a greater dimension in the shearing direction than an adjacent portion of the section, the corresponding portions as hereinbefore defined of the cutting edge and of said blade face, respectively, are arranged to be a greater distance from the plane of shearing than the corresponding adjacent portions as hereinbefore defined of the cutting edge and said blade face.

2. Apparatus for shearing metal sections as claimed in claim 1, wherein said corresponding portion of the cutting edge and of the blade face is formed by providing a recess in the blade face, extending in the shearing direction.

3. Apparatus for shearing metal sections as claimed in claim 2, wherein the recess is provided in the blade member arranged to be above the section.

4. Apparatus for shearing metal sections as claimed in claim 2, wherein the recess is provided in the blade member arranged to be below the section.

5. Apparatus for shearing metal sections as claimed in claim 2, wherein the recess is provided in both blade members.

6. Apparatus for shearing metal sections as claimed in any one of the preceding claims, wherein said blade face of said at least one blade member is arranged to be inclined at an angle of up to $10°$ from the shearing plane such that any portion of the cutting edge further from the other blade member than any other portion is at a greater distance than that other portion from the plane of shearing.

7. Apparatus for shearing metal sections as claimed in claim 6, wherein the inclination is within the range 1 to $10°$.

8. Apparatus for shearing metal sections as claimed in claim 6 or claim 7, wherein the inclination is provided by grinding said blade face.

9. Apparatus for shearing metal sections as claimed in claim 6 or 7, wherein the inclination is provided by mounting the blade member at an angle.

10. Apparatus for shearing metal sections as claimed in any one of claims 6 to 9, wherein said blade face of that blade member arranged to be above the section is inclined.

11. Apparatus for shearing metal sections as claimed in any one of claims 6 to 9, wherein said blade face of that blade member arranged to be below the section is inclined.

12. Apparatus for shearing metal sections as claimed in any one of claims 6 to 9, wherein said blade face of both blade members is arranged to be inclined.

13. Apparatus for shearing metal sections as claimed in any one of the preceding claims, wherein the section is a T-shaped beam.

14. Apparatus for shearing metal sections as claimed in any one of the preceding claims, wherein the section is an I-shaped beam.

15. Apparatus for shearing metal sections as claimed in any one of the preceding claims, wherein the section is a channel beam.

16. Apparatus for shearing metal sections substantially as herein described, with reference to and as shown in Figures 1 and 2, Figures 3 and 4, Figures 3a and 4a, Figures 5 and 6, Figures 7 and 8, Figures 9 and 10

or any one of Figures 11 to 13 of the accompanying drawings.

17. Metal sections sheared by apparatus as claimed in any one of the preceding claims.

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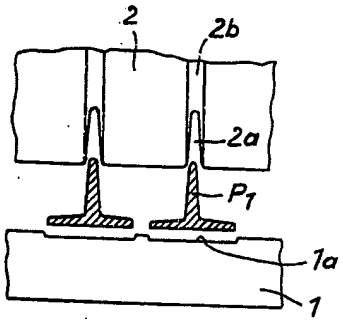


Fig.1

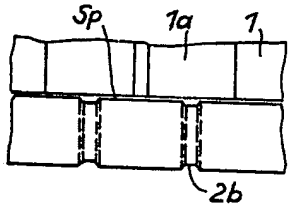


Fig.2

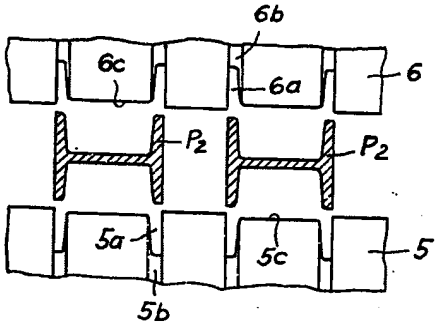


Fig.3

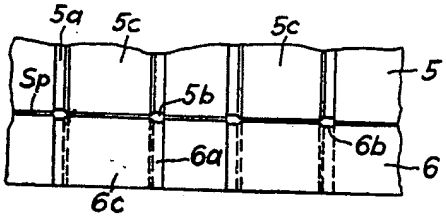


Fig.4

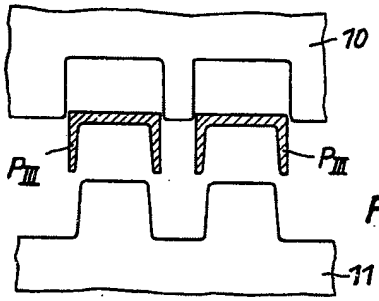
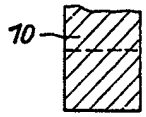


Fig. 5



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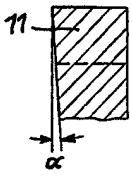


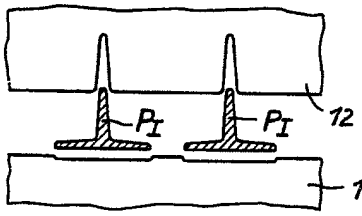


Fig. 7

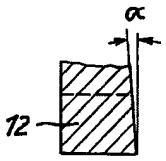
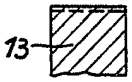


Fig. 8



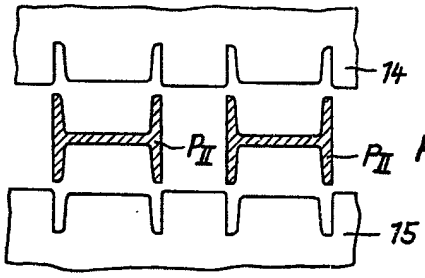


Fig. 9

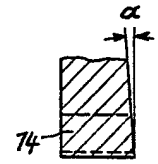


Fig. 10

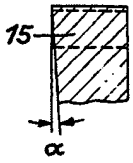


Fig. 11

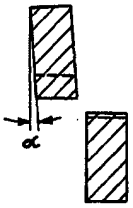


Fig. 12

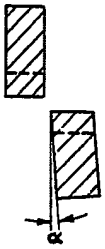
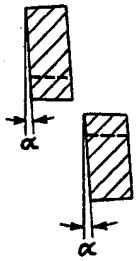


Fig. 13



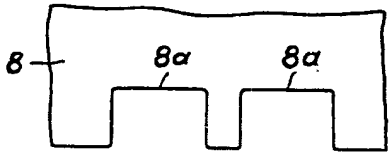
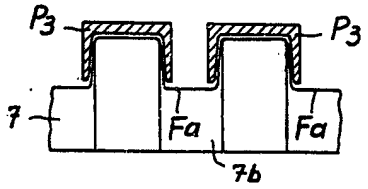


Fig. 3a



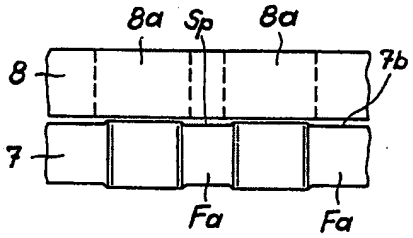


Fig. 4a